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*January 1998*

# *Mathematics 33*

## *Grade 12 Diploma Examination*

Alberta
EDUCATION

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*January 1998*

# *Mathematics 33*

## *Grade 12 Diploma Examination*

### *Description*

Time: 2.5 h. You may take an additional 0.5 h to complete the examination.

This is a **closed-book** examination consisting of

- 37 multiple-choice and 12 numerical-response questions of equal value, worth 70% of the examination
- 4 written-response questions, worth a total of 21 marks or 30% of the examination

Total possible marks: 70

This examination contains sets of related questions.

A set of questions may contain multiple-choice and/or numerical-response and/or written-response questions.

A mathematics data booklet is provided for your reference.

The perforated pages at the back of this booklet may be torn out and used for your rough work. No marks will be given for work done on the tear-out pages.

### *Instructions*

- Fill in the information required on the answer sheet and the examination booklet as directed by the presiding examiner.
- You are expected to provide your own scientific calculator.
- Use only an HB pencil to record your answer on the machine-scored answer sheet.
- If you wish to change an answer, erase **all** traces of your first answer.
- Do not fold the answer sheet.
- Now turn this page and read the detailed instructions for answering machine-scored and written-response questions.

## *Multiple Choice*

- Decide which of the choices **best** completes the statement or answers the question.
- Locate that question number on the separate answer sheet provided and fill in the circle that corresponds to your choice.

***Example***

This examination is for the subject of

**A.** mathematics
**B.** chemistry
**C.** biology
**D.** physics

Answer Sheet

● Ⓑ Ⓒ Ⓓ

## *Numerical Response*

- Record your answer on the answer sheet provided by writing it in the boxes and then filling in the corresponding circles.
- If an answer is a value between 0 and 1 (e.g., 0.25), then be sure to record the 0 before the decimal place.
- **Enter the first digit of your answer in the left-hand box and leave any unused boxes blank.**

***Example 1***

The value of tan 35° to the nearest tenth is _____.
(Record your answer on the answer sheet.)

Calculator value: 0.7002075
Value to be recorded: 0.7

**Record 0.7 on the answer sheet** →

### *Example 2*

The constant term in the quadratic function $y = 2x^2 + 7x + 32$ is _____.
(Record your answer on the answer sheet.)

Value to be recorded: 32

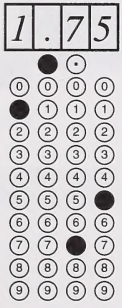
**Record 32 on the answer sheet** →

### *Example 3*

If an annual interest rate of 7% is compounded quarterly, then the quarterly rate to the nearest hundredth of a percent is _____%.
(Record your answer on the answer sheet.)

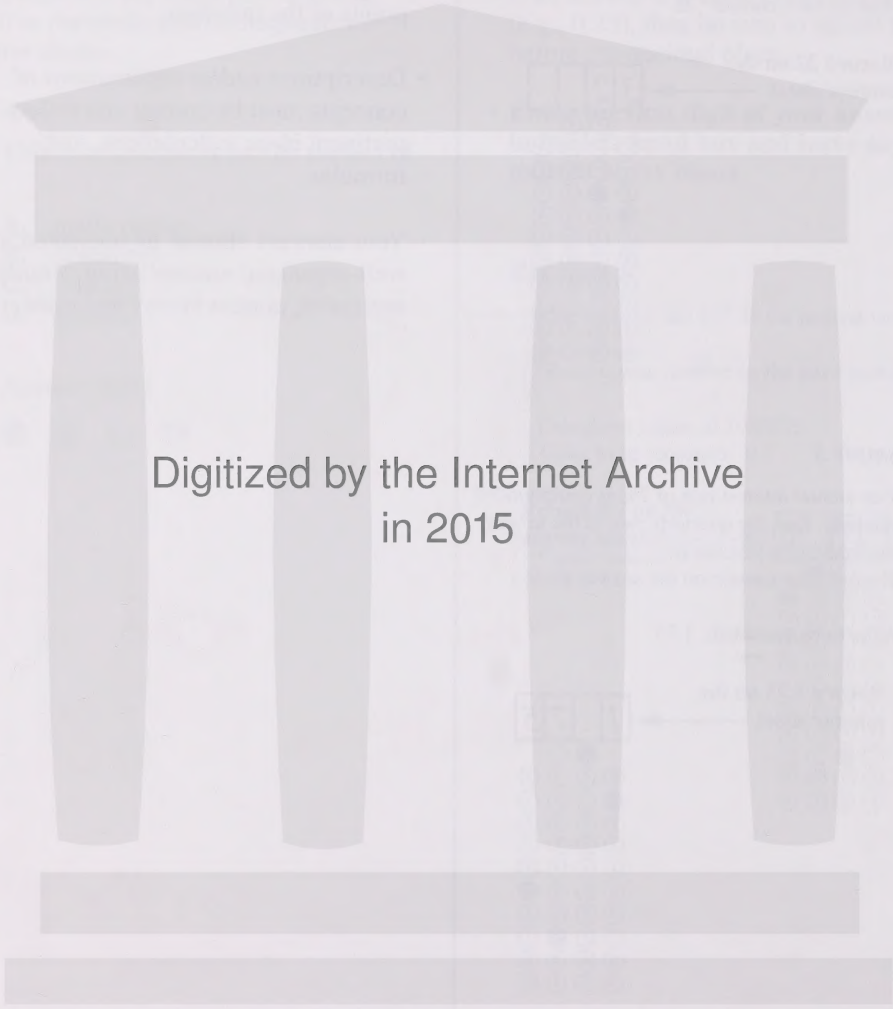
Value to be recorded: 1.75

**Record 1.75 on the answer sheet** →




## *Written Response*

- Write your answers in the examination booklet as neatly as possible.
- For full marks, your answers must be well organized and address **all** the main points of the question.
- Descriptions and/or explanations of concepts must be correct and reflect pertinent ideas, calculations, and formulas.
- Your answers **should be** presented in a well-organized manner using complete sentences, correct syntax and units.



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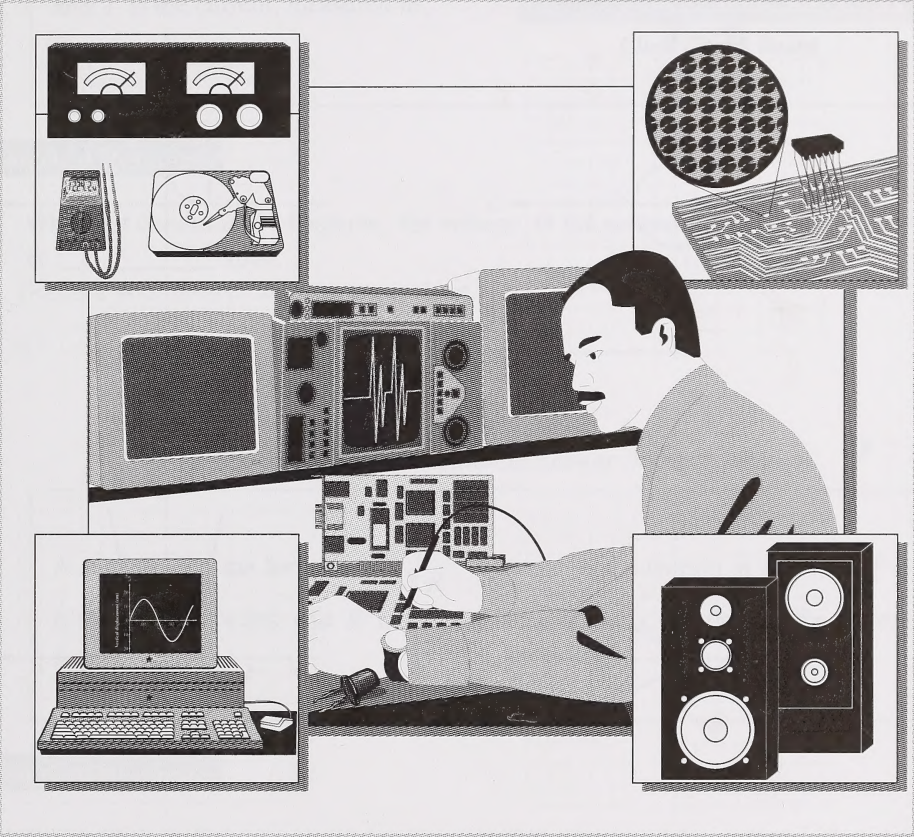
## TRAINING FOR ALBERTA INDUSTRIES

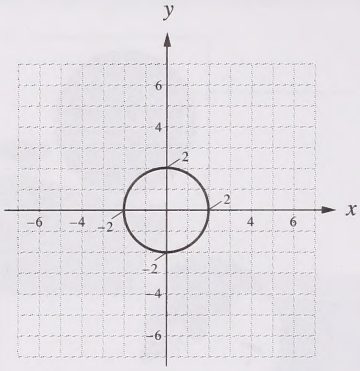
While attending college, students training for careers in Alberta industries such as electronic technologies and business apply mathematics in many situations. As well, colleges routinely use mathematics in their daily operations. The following set of questions is related to these applications.



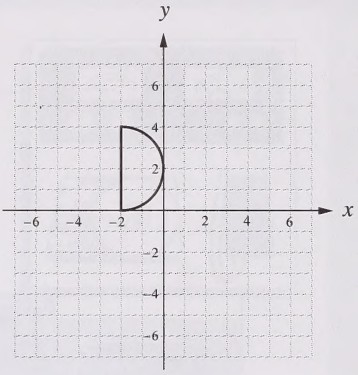
*In a mathematics lab, students were required to identify relations that are also functions.*

**1.** Which of the following graphs represents the graph of a function?

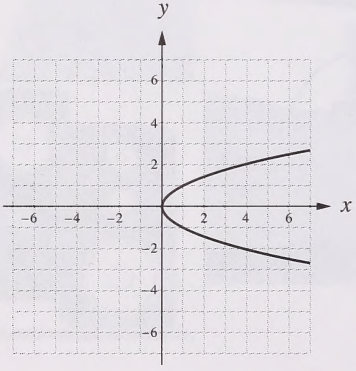
**A.**



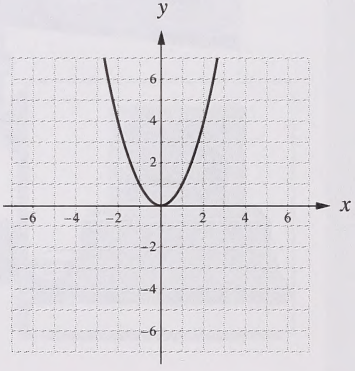

**B.**




**C.**

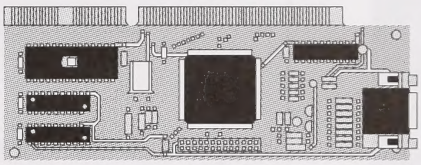



**D.**



*Use the following information to answer the next question.*

In analyzing a clock circuit, a student used the formula $V = \frac{40}{3}I$, where $V$ is the voltage, measured in volts, and $I$ is the current, measured in amperes.



**Clock Circuit Board**

**Numerical Response**

**1.** When the current is 27 amperes, the voltage, to the nearest volt, is _____ volts.
(Record your answer on the answer sheet.)

---

*Use the following information to answer the next question.*

A student used the formula $I = \sqrt{\frac{P}{R}}$, where $I$ is the current in amperes, $P$ is the power in watts, and $R$ is the resistance in ohms, to calculate the current in a circuit.

**Numerical Response**

**2.** For an electrical circuit where the power is 700 watts and the resistance is 50 ohms, the current $I$, to the nearest hundredth of an ampere, is _____ A.
(Record your answer on the answer sheet.)

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*Use the following information to answer the next question.*

To determine the lag factor in a control circuit, students in electronic technology studies used the formula

$$L = \frac{2K}{K^2 - 1},$$

where $K, L > 0$, and where $L$ is the lag factor and $K$ is a reduction factor.

**Written Response — 5 marks**

**1.** **a.** If $K = 1.5$, determine the value of $L$, to the nearest tenth.

**b.** Explain why a value for $L$ cannot be found when $K = 1$.

**c.** A student substituted $L = 4$ into $L = \dfrac{2K}{K^2 - 1}$ and then determined a quadratic equation. The first two steps in determining an equation in the form $ax^2 + bx + c = 0$ are shown below.

**Step 1** $\quad 4 = \dfrac{2K}{K^2 - 1}$

**Step 2** $\quad 4(K^2 - 1) = 2K$

- Complete the steps necessary to determine the quadratic equation in the form $ax^2 + bx + c = 0$.

- Show how you determine the value(s) of $K$ using the quadratic formula, and state the positive value of $K$.

*Use the following information to answer the next question.*

A student used three lengths of steel to build a support for an electronics communication tower. The student welded together the ends of the three lengths of steel so that they formed a triangle. The lengths of steel measured 6.1 cm, 7.1 cm, and 9.7 cm.

**2.** The measure of the smallest angle of this triangle was

**A.** 38.8°
**B.** 39.0°
**C.** 40.7°
**D.** 42.9°

---

*Use the following information to answer the next question.*

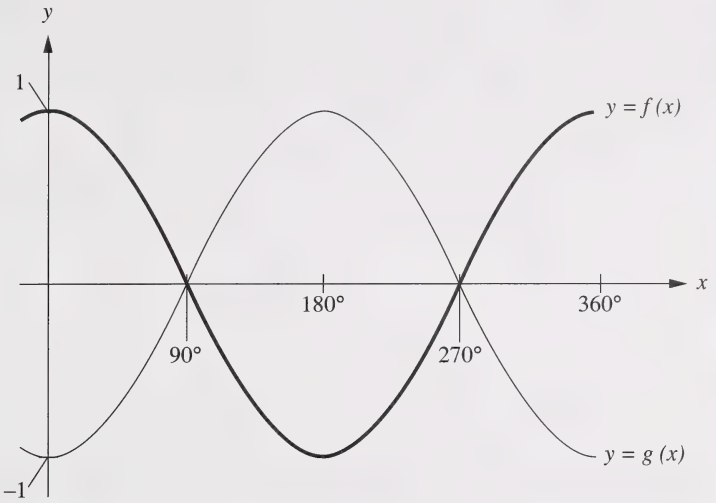
Electronic technology studies include training on computers and radar screens. In one class, an arm rotated about the centre of a radar screen so that an angle of $-80°$ was displayed in standard position.

**Numerical Response**

**3.** The measure of the angle between $0°$ and $360°$ that is coterminal with $-80°$ is _____ °.
(Record your answer on the answer sheet.)

*Use the following information to answer the next question.*

A student transformed the graph of the function $y = f(x)$ into the graph of $y = g(x)$, as shown below.




**3.** The function $g(x)$ expressed in terms of $f(x)$ is

**A.** $g(x) = f(x) - 1$
**B.** $g(x) = f(x - 1)$
**C.** $g(x) = f(-x)$
**D.** $g(x) = -f(x)$

---

*Use the following information to answer the next question.*

Students in electronics technology studies learned that a carrier wave is a radio wave of constant amplitude and frequency. A carrier wave can be represented by the sine function $y = a \sin b\theta$.

**4.** The parameter in the function that alters the amplitude of its graph is

**A.** $a$
**B.** $b$
**C.** $y$
**D.** $\theta$

*Use the following information to answer the next question.*

Six business students formed an investment company. They planned to start with a fixed amount of money, with each student investing an equal share. Before the initial investment was made, two more students joined the investment company and the proposed cost of each share was reduced by \$6 000. To determine the total amount of investment money, $x$, that the company started with, use the following steps. Steps 3 and 4 are incomplete.

**Step 1**: Let $x$ = Total amount of money invested

**Step 2**: (Original Cost per Share) – (Reduced Cost per Share) = 6 000

**Step 3**: $\frac{x}{6}$ – (  ) = **6 000**

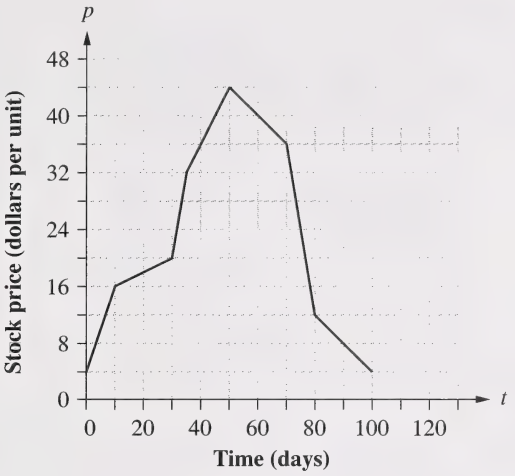
**Step 4**: $x$ =

**5.** According to the information above, the total amount of money invested was

**A.** \$150 000
**B.** \$144 000
**C.** \$48 000
**D.** \$36 000

*Use the following information to answer the next question.*

Using the following graph, the business students reviewed the price of a mining stock over a period of 100 days.




**Numerical Response**

**4.** The maximum stock price per unit over these 100 days, to the nearest dollar, was $\$_____$.
(Record your answer on the answer sheet.)

*Use the following information to answer the next question.*

A graduation committee planned a banquet for the graduates of the electronic studies technology program. They estimated that the total cost of the banquet, $c$, in dollars, would be given by the function

$$c = 20n + 300,$$

where $n$ is the number of graduates attending the banquet.

**6.** The function given above is **best** described as

**A.** linear
**B.** reciprocal
**C.** exponential
**D.** absolute value

---

*Use the following information to answer the next question.*

The college purchased a van to transport students to work-experience locations. To finance the vehicle, the college obtained a loan of $27 100 at 8.5% per annum for 5 years.

**Numerical Response**

**5.** The regular monthly payment on this loan, to the nearest dollar, is
$\$$_____ .
(Record your answer on the answer sheet.)

*Use the following information to answer the next question.*

The college administrators have determined that they will need to update and purchase new electronics equipment 5 years from now at a cost of $94 500. To acquire $94 500, they plan to deposit equal amounts of money at the beginning of every 6-month period for 5 years into an annuity that earns interest at 6% per annum, compounded semi-annually.

**Numerical Response**

**6.** The amount they will need to deposit every 6 months, to the nearest dollar, is $_____ .
(Record your answer on the answer sheet.)

---

*Use the following information to answer the next question.*

The administrators did a survey to determine the tuition needs of students. They asked 40 students, "Do you have sufficient money to pay next term's tuition fees?" Eleven students replied "yes." The administrators determined a 90% confidence interval for the proportion of "yes" responses.

**7.** If the administrators were to increase the sample size of students that they survey, the length of the confidence interval would

**A.** not change
**B.** be zero
**C.** increase
**D.** decrease

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**Written Response — 6 marks**

**2.** **a.** College graduates were randomly surveyed to determine whether or not they used a student loan to finance their post-secondary education. Twenty recent graduates were asked the following question: "Did you receive a student loan to finance your post-secondary education?" Of those surveyed, ten responded "yes."

- Using this survey and a 90% box plot chart, complete the following statement.

  "The 90% confidence interval for recent graduates who obtained student loans is between _____ % and _____ %."

- A sample of 100 recent graduates from the same college was then surveyed and asked the same question. Of these graduates surveyed, 50 responded "yes." Using a 90% box plot chart, write the 90% confidence interval statement based on this survey.

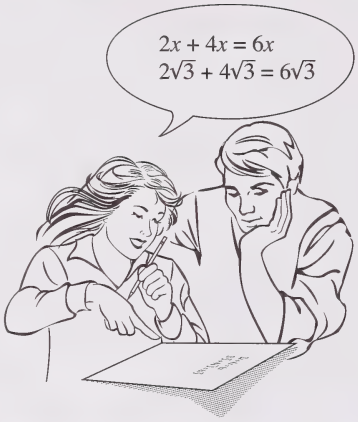
**b.** In both surveys, 50% of the graduates responded "yes," but the two confidence interval statements for the population differ from one another.

- Why do the confidence interval statements differ?

- Describe a possible error that could be made when choosing a sample, and explain how the error would influence the number of "yes" responses.

**CONNECTIONS**

Skills and understandings acquired in working with polynomials and fractions can be transferred to working with rational expressions, quadratics, and radicals. Where applicable, use your skills and understandings in these areas to answer the next ten questions.




**8.** Written as an entire radical, $5a\sqrt[3]{2}$, $a \neq 0$, is

**A.** $\sqrt[3]{10a}$

**B.** $\sqrt[3]{50a^2}$

**C.** $\sqrt[3]{250a^3}$

**D.** $\sqrt[3]{1\,000a^3}$

**9.** To rationalize the denominator of $\frac{\sqrt{5}}{4\sqrt{3}}$, the **best** strategy is to multiply the numerator and denominator by

**A.** $\sqrt{2}$

**B.** $\sqrt{3}$

**C.** $\sqrt{5}$

**D.** $\sqrt{10}$

**Numerical Response**

**7.** If $\sqrt{18}+2\sqrt{50}+a\sqrt{2}=120\sqrt{2}$, then the value of $a$ is _____.
(Record your answer on the answer sheet.)

**10.** The expression $\left(\sqrt{a}-3\sqrt{2}\right)\left(\sqrt{a}+3\sqrt{2}\right)$, where $a>0$, is equivalent to

**A.** $2\sqrt{a}-18\sqrt{2a}$
**B.** $a-18\sqrt{a}$
**C.** $2a+18$
**D.** $a-18$

**11.** The solution for $x$ in the equation $\sqrt{x-3}=b$, where $b>0$ and $x>3$, is

**A.** $b+3$
**B.** $b-3$
**C.** $b^2+3$
**D.** $b^2+9$

**Numerical Response**

**8.** The **largest** non-permissible value of $a$ for the rational expression $\frac{3}{a^2-100}\times\frac{3a-9}{a-10}$ is _____.
(Record your answer on the answer sheet.)

**12.** A simplified form of $\frac{4w^2 - 12w}{w^2 - 3w - 10} \div \frac{8w + 40}{w^2 + 7w + 10}$, where $w \neq -5, -2,$ or $5,$ is

**A.** $\frac{2w^2}{5}$

**B.** $\frac{4(w-3)}{-5}$

**C.** $\frac{w(w-3)}{2(w-5)}$

**D.** $\frac{4w(w-3)(w+2)}{(w-2)(w+5)}$

*Understandings of operations on rational numbers can be linked to simplifying rational expressions.*

**13.** If $\frac{x}{3} + \frac{2x+1}{x-2}$, where $x \neq 2,$ is written as a single fraction, then the numerator could be

**A.** $x^2 + 4x + 3$

**B.** $x^2 - 4x + 3$

**C.** $x^2 - 4x - 3$

**D.** $x^2 + 4x - 3$

*Use the following information to answer the next question.*

In solving an equation, a student wrote the following steps.

**Step I** $y - 2 - \frac{y+3}{2} = \frac{y}{3}$

**Step II** $6(y - 2) - 3(y + 3) = 2y$

**Step III** $6y - 12 - 3y + 9 = 2y$

**Step IV** $3y - 3 = 2y$

**Step V** $y - 3 = 0$

**Step VI** $y = 3$

**14.** The first error that the student made occurred in

**A.** step II
**B.** step III
**C.** step IV
**D.** step V

---

*Use the following information to answer the next question.*

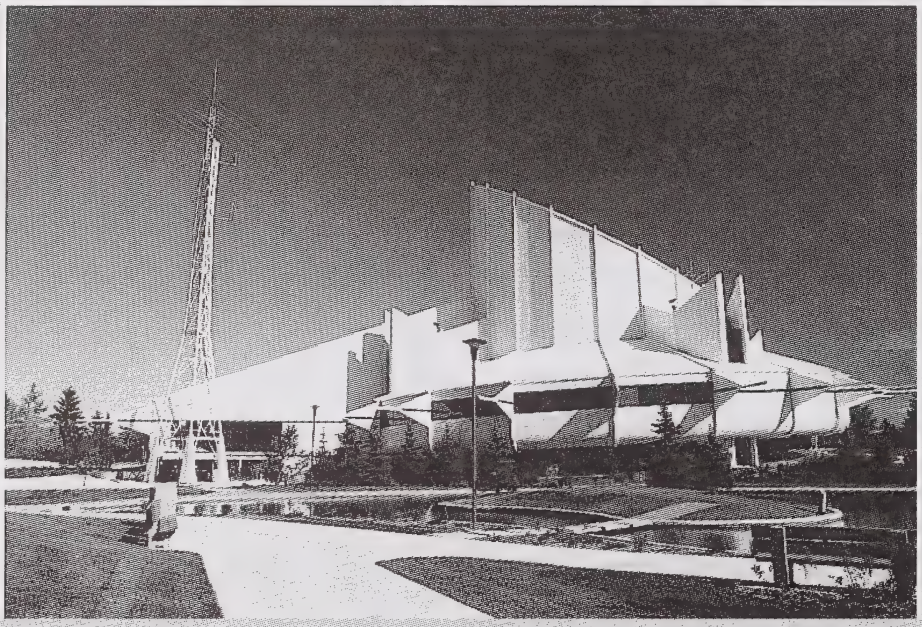
For the quadratic function $y = x^2 + 6x + 5$, a student let $y = 0$ and then wrote the equation $0 = x^2 + 6x + 5$. The student then factored to obtain $0 = (x + 5)(x + 1)$.

**15.** The factored form that the student used leads to the determination of the

**A.** vertex of the parabola
**B.** $y$-intercept of the parabola
**C.** $x$-intercepts of the parabola
**D.** maximum value of the parabola

**SCIENCE AND TECHNOLOGY**

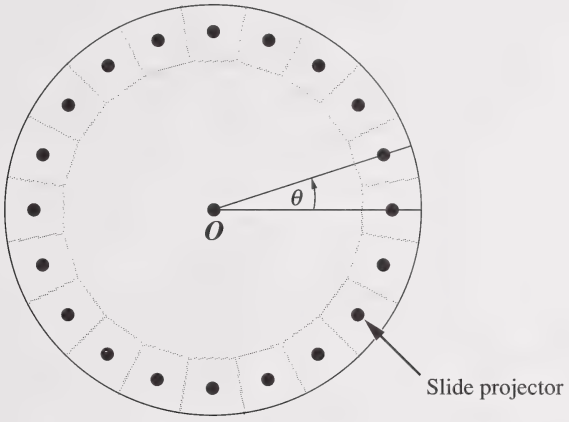
The following questions relate to the planning, construction, and daily operations of a Space and Science Centre. They require you to apply your mathematical understandings.



*—courtesy of the Edmonton Space & Science Centre*

*Use the following information to answer the next question.*

A star projector is located at the centre, $O$, of a circular planetarium room, and there are 20 slide projectors equally spaced around the perimeter of the room, as shown below.



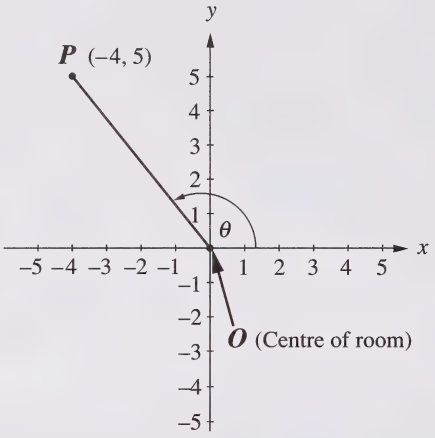

**Top View**

**Numerical Response**

**9.** The measure of angle $\theta$, formed between two adjacent slide projectors, to the nearest tenth of a degree, is _____°.
(Record your answer on the answer sheet.)

*Use the following information to answer the next question.*

Using a coordinate grid, designers positioned a projector so that its images could be projected to the centre of the room. On the graph below, the centre of the room is positioned at the origin, $O$, and the projector is positioned at the point $P(-4, 5)$.

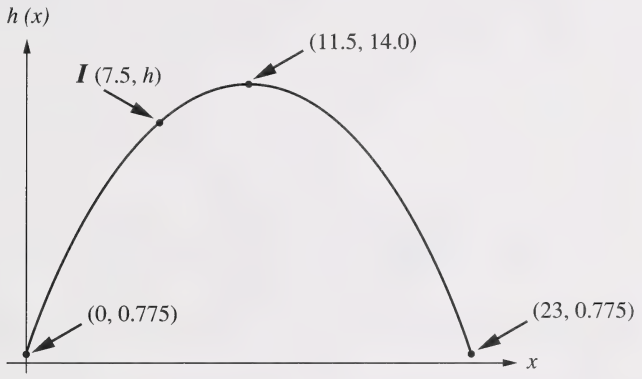



**Numerical Response**

**10.** The distance from the projector, $P$, to the centre of the room, $O$, to the nearest tenth of a unit, is _____.
(Record your answer on the answer sheet.)

*Use the following information to answer the next question.*

The relationship between the vertical height, $h(x)$, in metres, and the horizontal length, $x$, in metres, of the viewing dome in the planetarium can be approximated by the function $h(x) = -0.1(x - 11.5)^2 + 14.0$. The graph of this function is shown below.



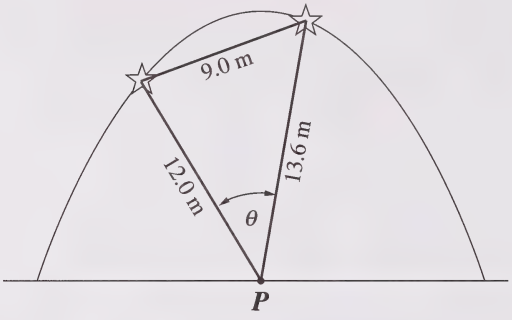

When the image of a point is projected onto the cross section of the dome, as shown above, at a location such as $I(7.5, h)$, the location of the point can be determined by using the function $h(x) = -0.1(x - 11.5)^2 + 14.0$.

**16.** For the point $I(7.5, h)$, the value of $h$, in metres, is

**A.** 10.0
**B.** 12.4
**C.** 13.4
**D.** 13.6

*Use the following information to answer the next question.*

Two bright "stars" are projected onto the viewing dome. The distance between the images of the two stars and the distance from each star's image to the projector, located at point $P$, are given in the diagram below. The measure of the angle at the vertex, $P$, is indicated by $\theta$.

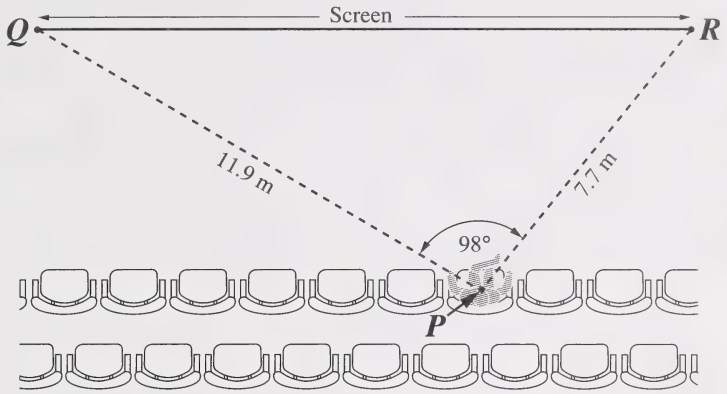



**17.** The measure of angle $\theta$ is

**A.** 79.3°
**B.** 60.1°
**C.** 48.6°
**D.** 40.6°

*Use the following information to answer the next question.*

A theatre was planned for the Space and Science Centre. The theatre designers planned the width of a screen by considering the viewing angles of patrons. The viewing angle of a patron sitting at a point $P$ in the front row is blueprinted below.




**18.** The planned width of the screen $\overline{QR}$, to the nearest metre, is

**A.** 13 m
**B.** 14 m
**C.** 15 m
**D.** 16 m

*Use the following information to answer the next question.*

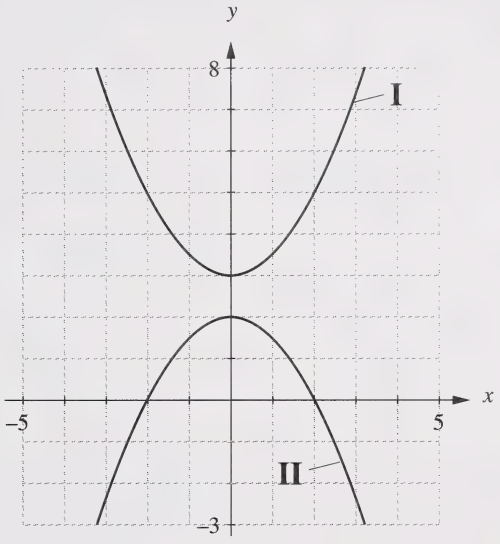
Contractors carpeted two **square** rooms near the theatre. One side of the larger square room is 6 m longer than a side of the smaller square room. The **total** area of the two square rooms is 260 $m^2$.

**19.** If the length, in metres, of a side of the smaller square room is represented by $x$, then an equation that could be used to determine $x$ is

**A.** $x(x + 6) = 260$
**B.** $x(x - 6) = 260$
**C.** $x^2 + (x + 6)^2 = 260$
**D.** $(x + 6)^2 + (x - 6)^2 = 260$

*Use the following information to answer the next question.*

The outline of a logo for the Space and Science Centre was designed by graphing two different quadratic functions. Each of the graphs was a transformation of the graph of $y = x^2$ and was produced by changing parameters in the function $y = a(x - h)^2 + k$.




**20.** The parameters that should be changed in the function $y = a(x - h)^2 + k$ to produce graph **II** from graph **I** are

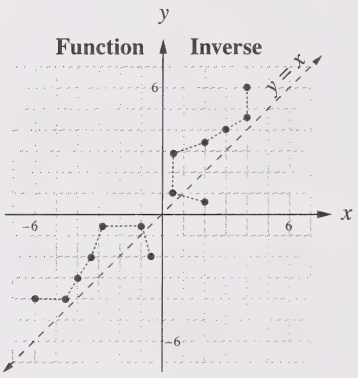
**A.** $a$ and $h$
**B.** $a$ and $k$
**C.** $h$ and $k$
**D.** $a$, $h$, and $k$

*Use the following information to answer the next question.*

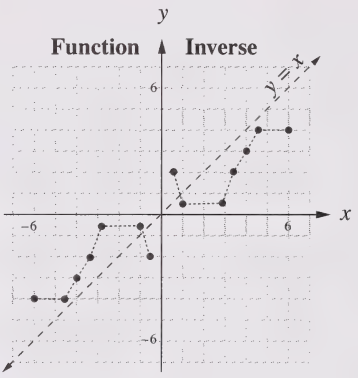
During a laser light show in the theatre, graphical images and their inverses were projected onto the screen to produce star constellations that looked like the Big Dipper.

**21.** Which of the following figures is obtained by graphing a function and its inverse?

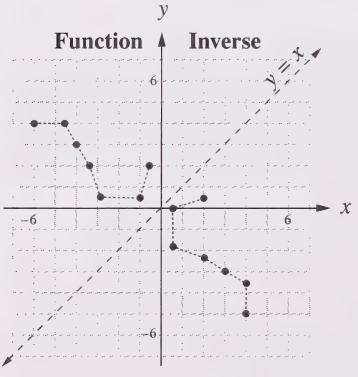
**A.**



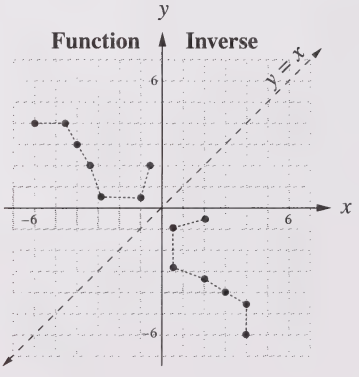

**B.**




**C.**




**D.**



*Use the following information to answer the next question.*

The table of values below shows a linear relationship between the number of people attending a movie in the theatre and the total money they spent at concessions.

| **Number of people in attendance** | 100 | 300 | 400 | 500 |
|---|---|---|---|---|
| **Total money spent at concessions** | $375 | $1 125 | $1 500 | $ 1 875 |

**Numerical Response**

**11.** If $1 275 is spent on concessions, then the number of people attending the movie is **most likely** _____.
(Record your answer on the answer sheet.)

---

*Use the following information to answer the next question.*

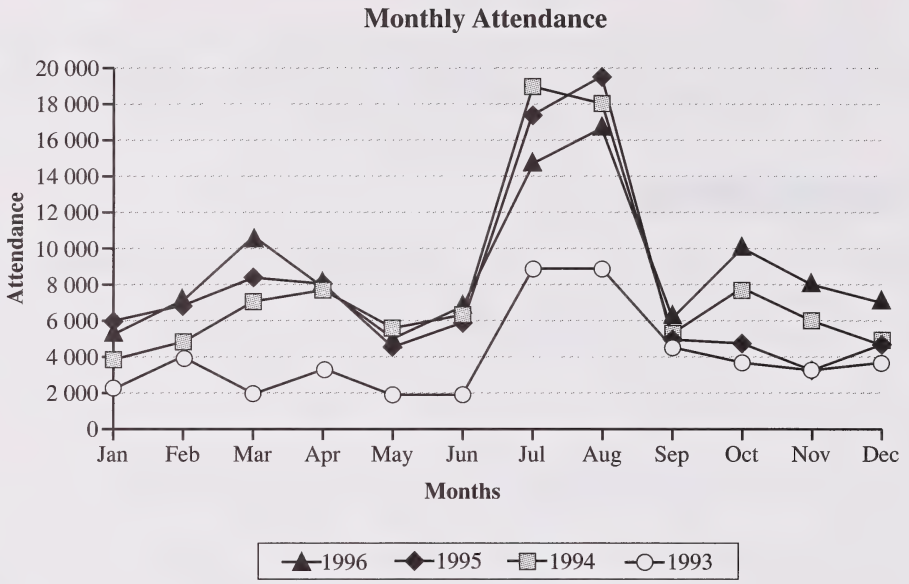
Management at the centre surveyed theatre patrons to determine if they were satisfied with a movie. They surveyed a random sample of 80 theatre patrons and asked "Were you satisfied with the movie?" Of the patrons surveyed, 56 said "yes."

**Numerical Response**

**12.** Based on this sample and a 90% box plot chart, the percentage of patrons attending the theatre that you would expect to be satisfied with this movie is between 65% and _____%.
(Record your answer on the answer sheet.)

*Use the following information to answer the next question.*

The monthly attendance at the Space and Science Centre for the years 1993 to 1996 is graphed below.

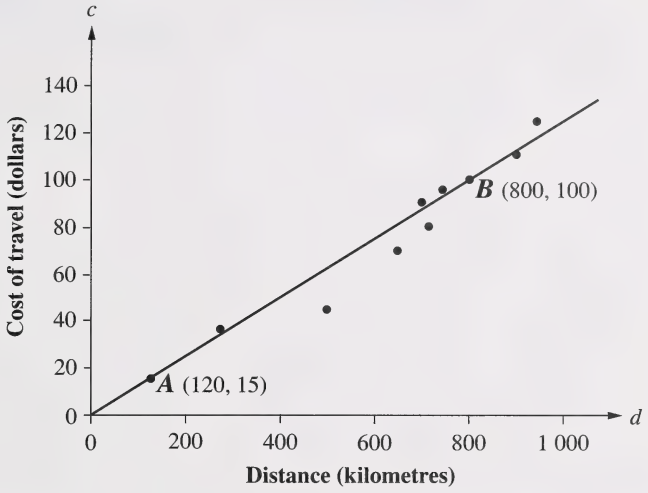



**22.** During which month was the attendance approximately the same for all four years?

**A.** February
**B.** May
**C.** June
**D.** September

*Use the following information to answer the next question.*

In planning tours for a special display, the Space and Science Centre staff compared the cost of travelling to the centre with the distance travelled. Data related to this comparison and a line of best fit for this data are shown in the scatter plot below.




**23.** If two points, $A(120, 15)$ and $B(800, 100)$, are on the line of best fit, then the equation for the line of best fit is

**A.** $c = 0.125d$

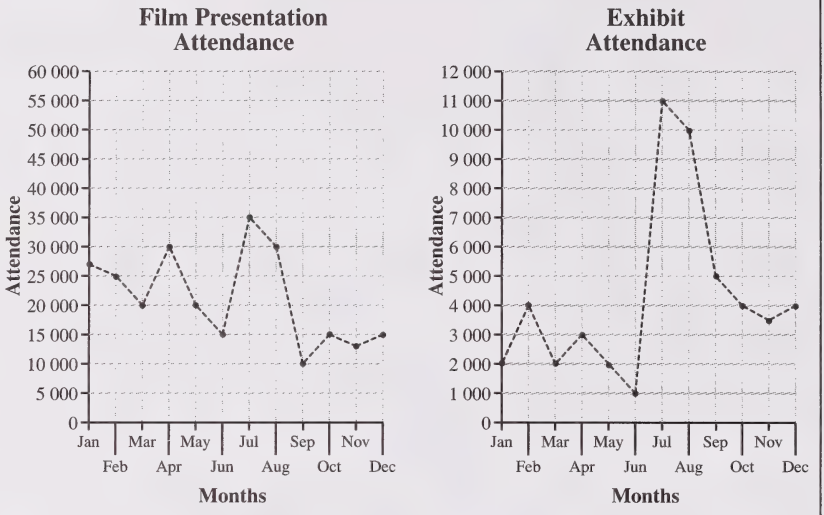
**B.** $c = 0.100d$

**C.** $c = 8d$

**D.** $c = 10d$

*Use the following information to answer the next question.*

Management at the Space and Science Centre used the graphs shown below to compare the past year's attendance at film presentations with attendance at the exhibits.



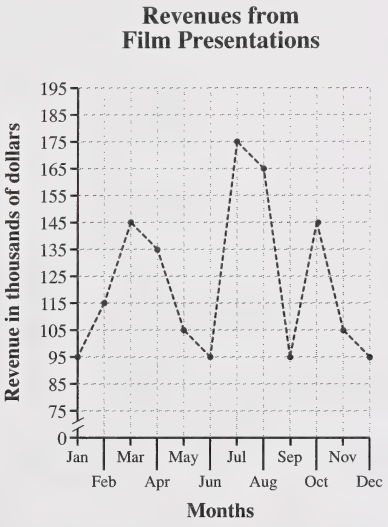

**Written Response — 5 marks**

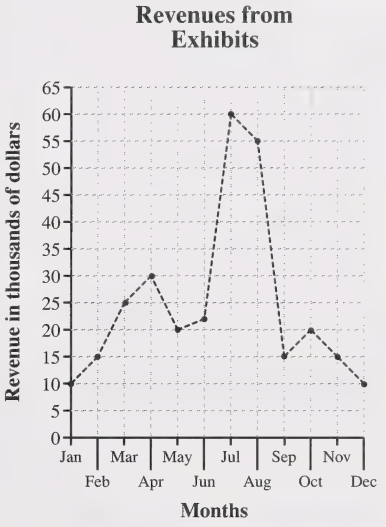
**3.** **a.** • For **each** graph, state the highest and lowest values.

• Compare and contrast the lowest attendance figure for the film presentations with the lowest attendance figure for exhibits.

*Use this additional information to answer the next question.*

Management realizes that it needs a minimum of $125 000 in total revenues each month from exhibits **and** film presentations to maintain operations. Management needs to obtain a loan to cover costs for months in which **combined** revenues fall below $125 000. Employees graphed revenues from all sources for the most recent year in order to determine the months in which the centre's **combined** revenues were below $125 000.




**b.** Determine a month when management would have to obtain a loan to help cover costs. Justify your answer using the information provided in the graphs above.

*Use the following information to answer the next question.*

To enhance attendance, an IMAX theatre was built onto the existing Space and Science Centre. The cost for the addition was $10 000 000. Management obtained a 25-year mortgage for $10 000 000 at an interest rate of 6% per annum.

**24.** If tables are used to calculate the monthly payments for this mortgage, one step that would have to be taken is

**A.** $10\,000 \times 12.78336$
**B.** $10\,000 \times 6.39807$
**C.** $10\,000\,000 \times 12.78336$
**D.** $10\,000\,000 \times 6.39807$

---

*Use the following information to answer the next question.*

Space and Science Centre management worked out a pension plan for employees in which each employee deposits $600 twice a year (January 1st and July 1st) and, at the same times, the employer deposits $400 into the same plan. The pension plan is to earn 9% per annum, compounded semi-annually.

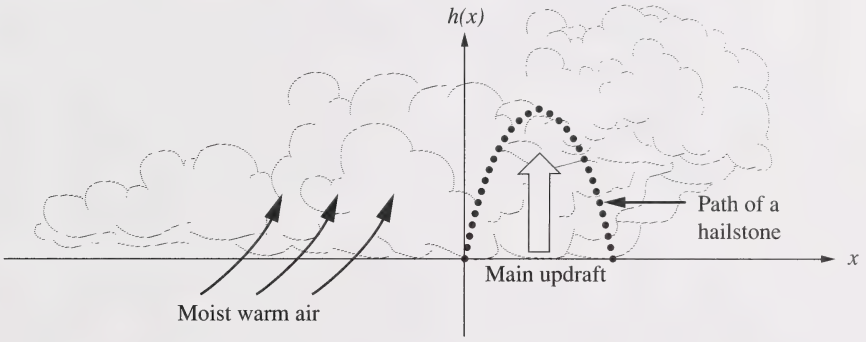
**25.** To determine the balance in an employee's pension account after 15 years of contributions, the pension administrator could **best** use the table entitled

**A.** Amount of an Annuity Table
**B.** Monthly Payment on a $1 000 Loan
**C.** Present Value of an Annuity Table
**D.** Monthly Payment on a $1 000 Mortgage

*The Space and Science Centre provides information about weather conditions and space exploration. The next four questions relate to these areas.*

*Use the following information to answer the next question.*

A meteorologist discovered that the path a hailstone follows in a cloud could be represented by the function $h(x) = -a(x-2)^2 + 5,\ a > 0,$ where $h(x)$ is the vertical distance in kilometres and $x$ is the horizontal distance in kilometres. A parabolic path related to this function is shown below.

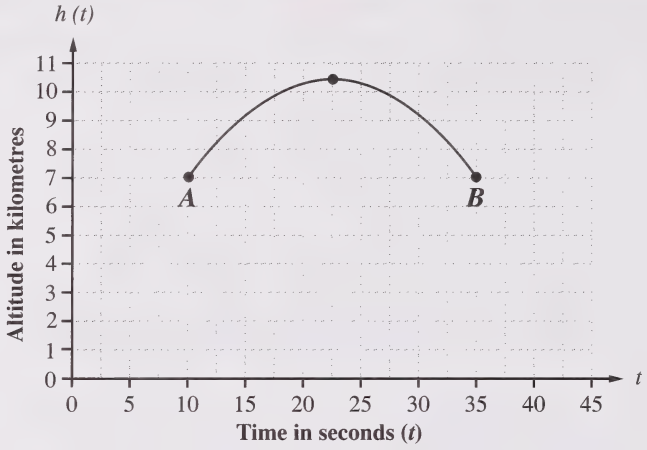



**26.** According to the function given above, the maximum vertical distance that a hailstone travels upward within a cloud is

**A.** 2 km
**B.** $2a$ km
**C.** 5 km
**D.** $5a$ km

*Use the following information to answer the next three questions.*

An exhibit at the Space and Science Centre contained the following information about astronaut training: "In order to simulate gravity-free conditions for training astronauts, a large military jet is flown along a curved path. The parabolic curve $\overset{\frown}{AB}$ represented in the graph below relates the altitude of the airplane, $h(t)$, in kilometres, to the time, $t$, in seconds."




**27.** According to the graph, the time at which the plane reaches its maximum height is

**A.** 7.0 s
**B.** 10.4 s
**C.** 22.5 s
**D.** 25.0 s

**28.** A possible function for this graph of the parabola where $10 \leq t \leq 35$ is

**A.** $h(t) = \frac{-1}{46}(t - 22.5)^2 + 10.4$

**B.** $h(t) = \frac{-1}{46}(t + 22.5)^2 + 10.4$

**C.** $h(t) = \frac{1}{46}(t - 22.5)^2 + 10.4$

**D.** $h(t) = \frac{1}{46}(t + 22.5)^2 + 10.4$

**29.** According to this graph, the apparent range for this manoeuvre is

**A.** $t$ is any real number

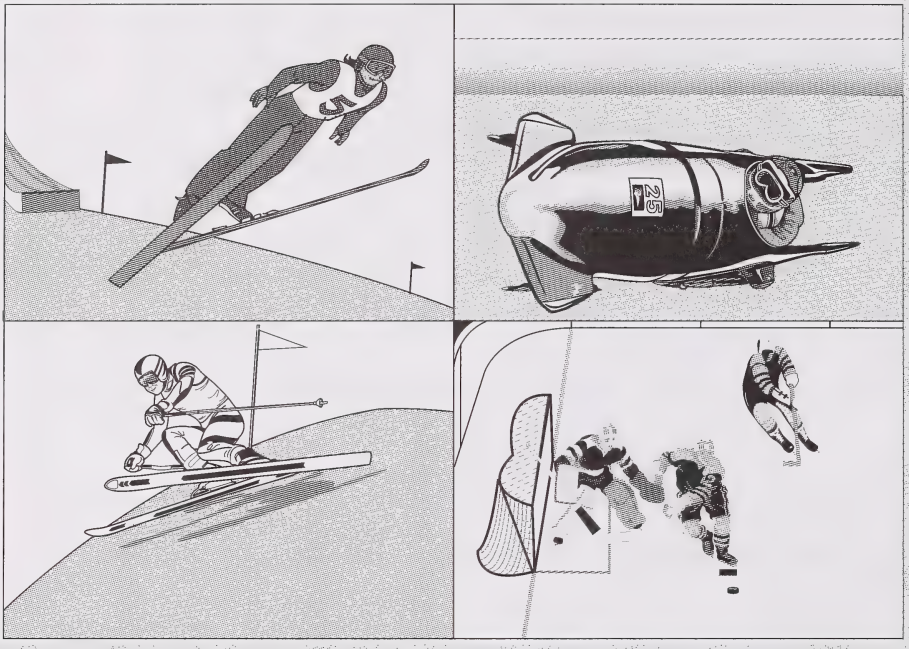
**B.** $10 \leq t \leq 35$

**C.** $h(t)$ is any real number

**D.** $7.0 \leq h(t) \leq 10.4$

## SPORTS AND RECREATION

Winter sports such as skiing, ice hockey, ringette, bobsledding, and ski jumping involve the use of mathematics to measure and analyze the performance of athletes during training and competition. Mathematics is also used in the equipping, maintenance, and operation of sports facilities. The next nine questions relate to these applications.



*Use the following information to answer the next question.*

In the off-season, Nordic skiers do dry-land training on roller blades. A ski coach analyzed a skier's dry-land training record by comparing the skier's average speed in metres per second with the distance the skier raced in metres. The skier's record is shown below.

**Ski Racer Dry-Land Training Record**

| **Distance of race (m)** | 100 | 200 | 400 | 800 | 1 000 | 1 500 |
|---|---|---|---|---|---|---|
| **Average speed (m/s)** | 9.13 | 9.03 | 7.99 | 6.86 | 6.56 | 6.15 |

**30.** According to the table above, which of the following statements **best** describes the relationship between the skier's average speed and the distance of the race?

**A.** As the distance of the race increases, the average speed of the racer decreases.

**B.** As the distance of the race increases, the average speed of the racer increases.

**C.** There is a positive correlation between the distance of the race and the average speed of the racer.

**D.** There is no correlation between the distance of the race and the average speed of the racer.

---

*Use the following information to answer the next question.*

The marketing staff at a ski resort conducted a yes/no survey to determine if customers were satisfied with the conditions of the downhill runs. They asked the following question, "Are you satisfied with the conditions of the downhill runs?"

**31.** To make inferences or predictions based on the results of this survey, marketing staff would be **best** advised to use a

**A.** scatter plot

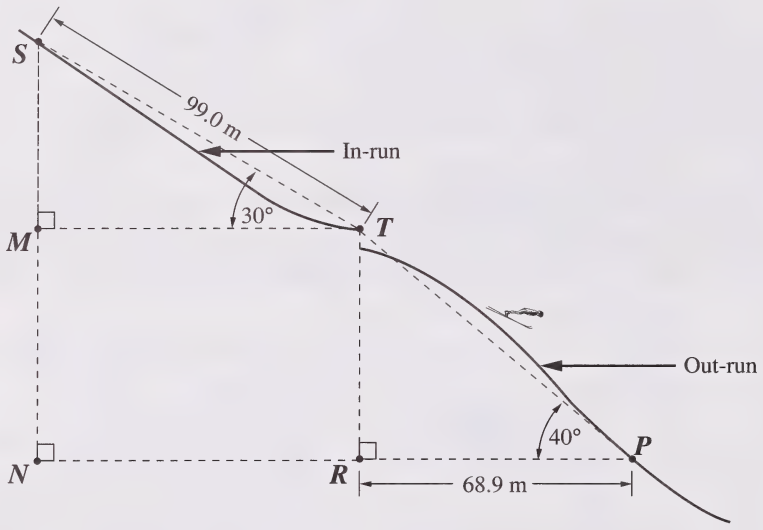
**B.** line of best fit

**C.** 90% box plot chart

**D.** stem and leaf diagram

*Use the following information to answer the next question.*

A ski jumper leaves the starting gates of a ski jump at a point labelled $S$, travels down the in-run (ramp), takes off from a point labelled $T$, and lands at a point labelled $P$ on the out-run (landing hill), as shown in the diagram below. The horizontal distance that the ski jumper travelled is $\overline{NP}$, and the vertical distance travelled is $\overline{SN}$.




**Written Response — 5 marks**

**4.** • Compare the length of the in-run with the distance $\overline{ST}$.

• Compare the length of the out-run with the distance $\overline{TP}$.

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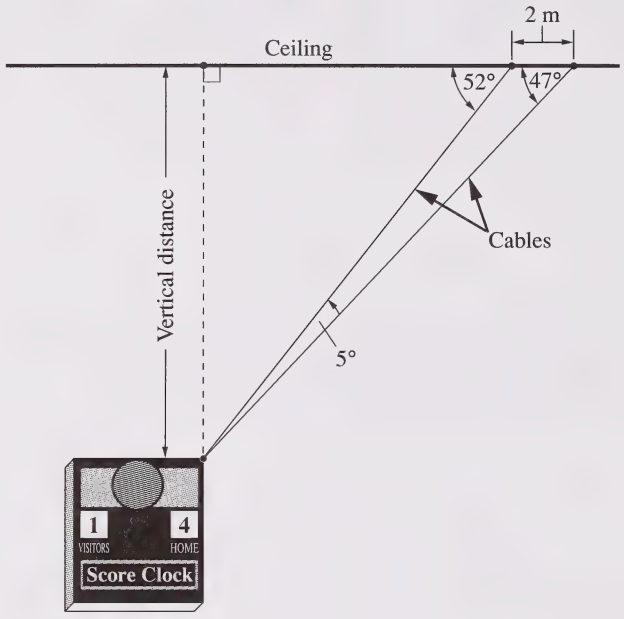
- Determine the distance $\overline{TP}$, and use it to estimate the actual distance, from $S$ to $P$, travelled by the ski jumper.

- Find the total vertical height $\overline{SN}$ that the ski jumper descended from the starting point to the landing point, and show mathematically how you obtained your answer.

*Use the following information to answer the next question.*

To support a score clock in an arena, two of the cables are attached from the ceiling to the score clock, as shown below. The cables are positioned 2 m apart, and their angles of depression are 47° and 52°.




**32.** The vertical distance between the top of the score clock and the ceiling is

**A.** 10.3 m
**B.** 13.2 m
**C.** 16.8 m
**D.** 18.1 m

*Use the following information to answer the next question.*

To purchase an ice-cleaning machine, a community association obtained a loan of $10 000. Interest was at 8% per annum, compounded semi-annually, and was calculated on the outstanding balance. The association made payments of $500.00 every six months. The complete entries for the first two payment periods are shown below. The entry for the third payment period is incomplete.

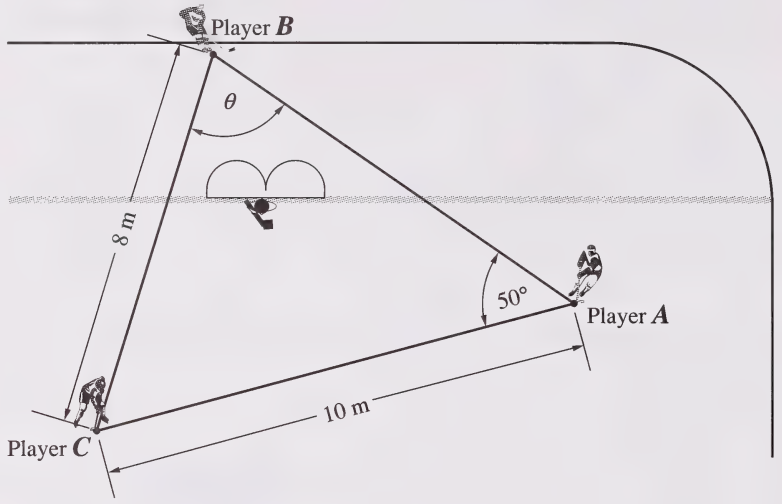
| Payment period | Outstanding balance | Interest per period | Regular payment | Final balance |
|---|---|---|---|---|
| 1 | $10 000.00 | $10 000 × 0.04 = $400.00 | $500.00 | $9 900.00 |
| 2 | $9 900.00 | $9 900 × 0.04 = $396.00 | $500.00 | $9 796.00 |
| 3 | $9 796.00 | *i* | $500.00 | – |

**33.** The amount of interest, *i*, that should be charged for the third payment period is

**A.** $391.00
**B.** $391.84
**C.** $392.00
**D.** $392.04

*Use the following information to answer the next question.*

During an ice hockey practice, the players performed the following drill. Player $B$ passed the puck to player $A$, who redirected it through an angle of $50°$ to player $C$, as shown below.

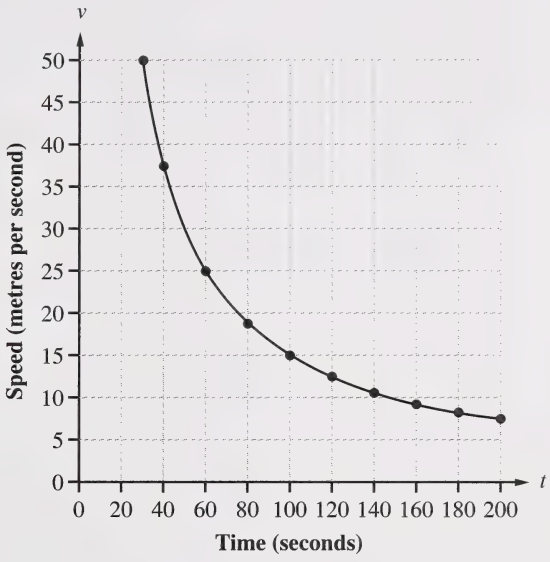



**34.** To the nearest degree, the measure of the acute angle $\theta$ in the diagram above is

**A.** 51°
**B.** 57°
**C.** 61°
**D.** 73°

*Use the following information to answer the next question.*

Bobsled coaches used the graph below to analyze the relationship between time and the average speed for a bobsled over a particular course.




**35.** The graph above **best** represents

**A.** a linear function
**B.** a quadratic function
**C.** a reciprocal function
**D.** an absolute value function

*Use the following information to answer the next question.*

The time separating teams at bobsled races is often extremely close. During a 1 300 m race, the difference in time between the first-place team and the tenth-place team was only 1.2 s. The difference between their speeds was 1.0 m/s. To calculate $x$, the time in seconds that it took the slower bobsled to cover the course, the following rational equation was used.

$$\frac{1\,300}{x-1.2} - \frac{1\,300}{x} = 1.0$$

**36.** The time $x$ of the slower bobsled was

**A.** 38.9 s
**B.** 40.1 s
**C.** 40.9 s
**D.** 41.3 s

---

*Use the following information to answer the next question.*

An aerial skier travels on a parabolic path that can be illustrated by the graph of the function $h = -5(t-1)^2 + 7$, where $h$ is the height of the skier above the ground, in metres, and $t$ is the time, in seconds, after the skier leaves the ground.

**37.** The graph of the function $h = -5(t-1)^2 + 7$ has an axis of symmetry

**A.** $t = 7$
**B.** $t = 1$
**C.** $t = -1$
**D.** $t = -5$

***No marks will be given for work done on this page.***

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***No marks will be given for work done on this page.***

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# Mathematics 33

## January 1998

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